

WHAT IS CLAIMED IS:

1. A method for detecting an open door of a refrigerator door, the refrigerator including at least one door, at least one switch configured to be activated by opening of said door, and at least one detection circuit including at least one phase shift circuit coupled to an opto-coupler and a processor, said method comprising the
5 steps of:

receiving a signal from said switch when said switch is activated;

phase-shifting the signal;

feeding the phase-shifted signal to the processor; and

monitoring an output signal from the opto-coupler; and

10 comparing said output signal with a line signal to determine whether the door is open..

2. A method in accordance with Claim 1 wherein said step of phase-shifting the signal comprises the steps of:

rectifying the signal; and

15 phase-shifting the rectified signal.

3. A method in accordance with Claim 2 wherein said step of rectifying the signal comprises the step of half-wave rectifying the signal.

4. A method in accordance with Claim 2 wherein said step of phase-shifting the rectified signal comprises the step of producing a shifted voltage leading a
20 line voltage.

5. A method in accordance with Claim 4 wherein the shifted voltage leads the line voltage by a lead value between zero degrees and 90 degrees.

6. A method in accordance with Claim 2 wherein said step of phase-shifting the rectified signal comprises the step of producing a shifted voltage lagging a line voltage.

5 7. A method in accordance with Claim 6 wherein the shifted voltage lags the line voltage by a lag value between zero degrees and -90 degrees.

8. A method in accordance with Claim 1 wherein the refrigerator includes a plurality of doors and corresponding switches, said method further comprising the steps of:

10 receiving a signal from each respective switch when each switch is activated;

phase-shifting the signal from each respective switch;

mixing phase-shifted signals for the respective switches; and

supplying the mixed signal to a processor.

15 9. A method in accordance with Claim 8 wherein said step of supplying the mixed signal to a processor comprises the step of isolating the mixed signal using an opto-coupler.

10. A method in accordance with Claim 8 wherein further comprising the steps of:

20 converting a value in degrees of phase shifting of the mixed signal to a time value; and

determining which of the doors is open using the time value.

11. A method in accordance with Claim 8 further comprising the step of shifting a phase of a signal output by one activated switch to a degree different in magnitude from a degree of shift of another switch signal output.

12. A method in accordance with Claim 8 wherein said steps of phase shifting and mixing the phase-shifted signals are performed using a single component.

13. An apparatus for detecting refrigerator door openings, the refrigerator including at least one switch configured to be activated by a door opening,
5 said apparatus configured to:

phase-shift a signal output by an activated switch; and

determine whether a door is open using the shifted signal.

14. An apparatus in accordance with Claim 13 wherein said apparatus is further configured to rectify the signal; and phase-shift the rectified signal.

10 15. An apparatus in accordance with Claim 14 further configured to half-wave rectify the signal.

16. An apparatus in accordance with Claim 14 further configured to produce a shifted voltage leading a line voltage.

15 17. An apparatus in accordance with Claim 16 further configured to produce a shifted voltage leading the line voltage by a lead value between zero degrees and 90 degrees.

18. An apparatus in accordance with Claim 14 further configured to produce a shifted voltage lagging a line voltage.

20 19. An apparatus in accordance with Claim 18 further configured to produce a shifted voltage lagging the line voltage by a lag value between zero degrees and -90 degrees.

20. An apparatus in accordance with Claim 13 wherein the refrigerator includes a plurality of doors and corresponding switches, said apparatus further configured to:

25 mix the phase-shifted signals output by activated switches; and

supply the mixed signal to a processor.

21. An apparatus in accordance with Claim 20 further configured to isolate the mixed signal using an opto-coupler.

22. An apparatus in accordance with Claim 20 further configured to:

5 convert a value in degrees of phase shifting of the mixed signal to a time value; and

determine which of the doors is open using the time value.

10 23. An apparatus in accordance with Claim 20 further configured to shift a phase of a signal output by one activated switch to a degree different in magnitude from a degree of shift of another switch signal output.

24. An apparatus in accordance with Claim 20 further comprising a single component configured to phase shift and mix the phase-shifted signals.